DOCUMENT RESUME

ED 464 658 JC 020 349

AUTHOR McClendon, Marie; McArdle, Michele
TITLE Comparing Alternative Algebraic Modalities for Remedial Students.
PUB DATE 2002-02-00
NOTE 21p.; Paper presented at the Chair Academy Leadership Conference (Kansas City, MO, February 28-March 2, 2002).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Algebra; Community Colleges; Comparative Analysis; Compensatory Education; Developmental Studies Programs; Educationally Disadvantaged; *Experimental Teaching; *Mathematics Instruction; *Outcomes of Education; *Remedial Mathematics; Special Needs Students; State Aid; Transitional Programs; Two Year Colleges; Withdrawal (Education)
IDENTIFIERS *Valencia Community College FL

ABSTRACT

This paper reports that the student population enrolled in remedial mathematics is rapidly increasing, while funding for these classes in Florida is declining. The Math Department at the Winter Park Campus (WPC) of Florida's Valencia Community College (VCC) has developed a curriculum that offers a variety of instructional formats to its remedial students. Since 1995, VCC has been transforming itself from a teaching-centered institution to a learning-centered one. The Math Department tested three learning modalities: traditional lecture, Academic Systems (an Internet-accessed software curriculum that provides students with combinations of lectures, practice programs, and self-administered assessment tests), and ALEKS (a non-linear, non-traditional Internet-based course). The traditional lecture class had the highest retention rate (60%), ALEKS the lowest (39%). However, there was not a significant difference in outcomes when students were placed in a learning modality that reflected their preferred learning style. According to a student survey, although 83% of remedial algebra students preferred lecture format, the authors argue that the 17% who preferred non-traditional methods need access to nontraditional learning methods. This report also provides demographic statistics regarding WPC's students: (1) with 1,500 credit students, WPC is the smallest of the four campuses in the VCC system; (2) WPC's student body is 69% Caucasian, 14% African American, and 12% Hispanic; (3) 65% of enrolled students are female, and over 75% of students are enrolled part time; and (4) the average student is 27 years old. Appended are course management suggestions and student survey results. (NB)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 464 658

Comparing Alternative Algebraic Modalities For Remedial Students

Marie McClendon

Michele McArdle

A Paper Presented at the

Chair Academy Leadership Conference

Kansas City, Missouri

February, 2002

TC020349

m. mcclendon

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

Comparing Alternative Algebraic Modalities For Remedial Students

Abstract

This paper compares the learning outcomes of remedial students enrolled in traditional lecture courses with those in an Academic Systems or an ALEKS course. This paper also provides information about the academic backgrounds of the students that participated in the study, their retention and success rates, and cost comparisons for implementing and maintaining the three different learning modalities. The paper concludes that there is no significant difference in student outcomes for the three learning modalities when students are enrolled in a system of instruction that corresponds to their preferred learning styles. It also concludes that lecture based courses offer the most cost effective method of instruction.

Context

Remedial mathematics education is an increasingly important concern to educators and administrators. The student population enrolled in remedial mathematics is rapidly increasing while funding for these courses is actually declining in Florida. Learning leaders are challenged to offer courses that maximize student learning while minimizing the demands on limited resources. In recent years, in order to increase its effectiveness with remedial student learning outcomes, the Math Department at the Winter Park Campus of Valencia Community College has evolved a curriculum that offers a variety of instructional formats. The academic and institutional environment that is characteristic of the Valencia Community College system within which this study was conducted is relevant as to why and how we were able to undertake this research.

Valencia Community College Information and Student Profile

Valencia Community College is comprised of four distinct campuses with an enrollment of 40,397 credit students and 11,265 continuing education students. Valencia has conferred 59,367 Associate degrees (AA and A.S.) and certificates in its 33 years of operation. Students may choose from approximately 50 disciplines or areas of concentration within the A. A. degree. More than half of Valencia's enrollment (58%) is in the AA. degree program. Over 80% of Valencia graduates earn an AA degree, and nearly 80% of those graduating continue their education at universities. There are about fifty AS and three AAS degree programs available, and

approximately 22% of the credit student population is enrolled in one of these programs. Ninety-four percent of the AS/AAS graduates are placed in jobs related to their degrees within one year after graduation.

Valencia's typical credit student is Caucasian and 21 years old. The representative student is enrolled part time for 8.4 credit hours, attends day classes, and seeks an AA degree. Almost 42% of the credit population comes from non-Caucasian groups. Overall, the credit student body is 57% female and 43% male, with about 65% of the credit students enrolled on a part-time bases, while 72% of the credit population attend classes during the day.

This research project was conducted at the Winter Park Campus, the smallest of the four campuses. Started as a Women's Center in the early 1980's, this campus has grown into a diverse, multi-disciplined institution with over 1500 enrolled credit students. It also serves as home to the Valencia Institute which offers continuing education courses and re-certification for many specialties. In contrast to the representative student of the college at large, are the characteristics of the representative Winter Park student. The student body is 69% Caucasian, 14% African American and 11.5% Hispanics. The latter two groups have seen expanded enrollments in the last two years. Females represent 65.3% of the enrollment compared to 34.6% male. Over 75% of the students are part-time with over 50% of the students taking 1 to 8 credit hours. The average student is 27 years of age.

The Winter Park Campus is a learning-centered academic community composed of students, faculty and staff. It provides a supportive environment that encourages and challenges learners to think, communicate, value and act in order to acquire the knowledge and skills necessary to achieve their personal goals. It offers a variety of learning opportunities to ensure a positive experience. The Winter Park Campus upholds and supports the rigorous academic requirements that are the foundation of Valencia's reputation.

The student demographics of the Winter Park Campus present particular learning challenges. A large number of non-traditional students are demanding that learning be relevant and are seeking real world applications of theoretical concepts. They expect a high level of expertise in course content and delivery based on their enhanced life experiences.

The Valencia Learning Centered Initiative

It is useful for the reader to have some background information regarding the transformational changes that have been occurring at Valencia in the last several years. The journey toward the goal of becoming a learning-centered college began in 1995, when Valencia proposed that its ACE/Kellogg project would support changing the College from a teaching-centered institution to a more learning-centered institution. The project was intended to examine the extent to which learning occurs, and the extent to which students are prepared for the next step in their educational and working lives as a result of what they learned at Valencia. During this phase, faculty, staff and administrators collaboratively designed, developed and implemented strategies to improve communication, share decision-making, and promote leadership opportunities. New core competencies and core processes to strengthen the learning process were designed and implemented. In phase II of the initiative the College focused on the continuation and the institutionalization of the learning-centered philosophy. Valencia's President, Dr. Sanford Shugart, following his arrival in 2000, initiated the Phase III planning process. He has established a new decision-making structure in conjuncture with faculty and staff to oversee the development, implementation, and evaluation of the work plans designed to achieve the strategic goals and strategies over a three-year period. The College has established a number of measures identified as indicators of progress. The seven strategic goals are as follows:

Learning First- Shape the culture of Valencia by making learning the chief value and design principle in every College policy, procedure, plan, and initiative. In every decision, we will consciously ask two questions: "How will this enhance student learning?" and "How do we know this will enhance student learning?"

Start Right – Commit to dramatic improvement in student mastery of core competencies and foundation learning outcomes that will largely govern their success, their performance in advanced collegiate studies, and their persistence to graduation. Make this a major investment priority and the focus of much of the early effort in the Learning-Centered Initiative.

Learning Leaders – Invest in faculty and staff, the people who most directly affect the quality of student learning.

Learning by Design – Create a culture where clearly specified learning outcomes and assessments engage students as responsible partners in their learning and where the college's learning leaders can effectively create the best conditions for learning.

Learning Support Systems – Create systems of learning support that will complement classroom and other modes of learning and enable students to achieve extraordinary learning results.

Diversity Works – Marshal the power of diversity to enhance learning and the College's impact on the community.

Learning Works – Valencia has a vital mission in economic development and this mission, too, is governed by learning-centered principles.

The Strategic Plan for the credit programs of the Winter Park Campus support the following three overall goals of the College: Start Right; Learning Leaders; and Learning Support Systems. In the area of mathematics the plan identifies the following goals:

1. To strengthen the delivery of preparatory courses in English, mathematics and reading.
2. To invest in faculty and staff, the people who most directly affect the quality of student learning.
3. To supplement the instruction that occurs in the classroom with additional supports including the Math and Communication Support Centers, the Technology Resource Center and the use of supplemental instructors in the front door and transition courses

These goals are support by budget requests that are tied to one or more of the seven strategic goals. For the purposes of this study, funds were requested for the computer software packages and for training from the credit department and for the supplemental instructors from the student activities funds.

As part of the Strategic Learning Plan, the Winter Park Campus Mathematics Department, developed a mission statement that supports the Campus goals and learning philosophy. The Winter Park Campus Mathematics Department comprises a team of professionals dedicated to helping students successfully achieve their educational goals. Our team members offer a supportive environment in the classroom and lab that encourages questions, motivates students, and applies mathematics to the real world. We provide delivery systems that meet individual student's learning styles. Our team of professionals consists of the two full time - tenure track faculty, one full time student support center paraprofessional, and twelve adjunct faculty. The courses we offer are limited to Pre-Algebra, Elementary Algebra, Intermediate Algebra, College Algebra, College Math and Liberal Arts Mathematics, Statistics, Pre-Calculus Algebra, Trigonometry and Business Calculus.

Overview of Elementary Algebra

A Valencia graduate with an AA degree must complete six hours of college level mathematics, two of the following courses: college algebra, college math and liberal arts

mathematics, statistics, pre-calculus algebra, trigonometry and business calculus or higher levels. For a student who has placed into a remedial course, elementary algebra has been determined to be a predictor of success in the college level mathematics courses. Elementary algebra is the course in which students achieve the mathematical maturity, skill and conceptual knowledge to successfully complete the math course sequence. Elementary algebra is also the terminating course for many of the A.S. degree-seeking students. This course is such a pivot point in the mathematics curriculum that the State of Florida mandates that enrolled students must pass an Elementary Algebra State Competency Test. A student must score, using Valencia's standards, an 80% or above on the state test to be eligible to receive a passing grade in the course.

Students enrolling in elementary algebra have either successfully completed a pre-algebra course or directly placed into the course by scoring a 42 or above on the CPT (College Placement Test). In the State of Florida, if a registering student does not have sufficient SAT or ACT scores to be placed into a college level course, the CPT is administered to determine the student's ability in reading (CPTR), writing (CPTW), and algebra (CPTA). The test is adaptive and if a student does not demonstrate sufficient algebra skills the computer program selects questions that use the College Placement Test of Mathematics (CPTM) in order to measure the student's knowledge of basic arithmetic skills.

Valencia Community College has determined that a reading score below 83 on the CPTR test mandates students into prep reading, a writing score below 83 on the CPTW test mandates students into prep writing, and an algebra score between 42 and 71 on the CPTA test mandates students into elementary algebra. When using $\alpha = 5\%$, there was not a significant difference in CPT scores for students enrolled in the three modalities.

Student Profile for Each Modality

	Lecture	Academic Systems	ALEKS
CPTR	101.3	123.0	129.6
CPTW	106.34	121.3	138.6
CPTM	54.9	55.1	59.8
CPTA	46.4	51.1	51.9

Data from the high school graduates from the year 2000 from the seventeen high schools

in the service district indicates that remediation courses were required for 1,184 students or 52% of the incoming students in mathematics, 693 students or 30.6% in writing, and 949 students or 42% in reading.

Demographic Profile of Students by Course

	Lecture	Academic Systems	ALEKS
Mean Age	23.0	23.0	21.3
Male	38.8%	50%	42.2%
Female	61.2%	50%	57.8%
Caucasian	67.3%	76.9%	68.9%
African American	16.3%	7.7%	8.9%
Hispanic	14.3%	11.5%	15.6%
Other	2.0%	3.8%	6.7%

Demographically, Academic Systems had a significantly higher percentage of Caucasians than either lecture or ALEKS. This is probably due to economic factors rather than culturally bias factors. Both students and advisors were aware that Academic Systems is a computerized based course. Since this was ALEKS' initial offering students and advisors did not fully understand that it was a computerized based course.

Overview of Delivery Systems

The three learning modalities tested in this experiment were traditional lecture, Academic Systems and ALEKS. A brief summary of the characteristics of each system follows.

Traditional Lecture: The traditional lecture delivery is familiar to both students and instructors. It is instructor led, directed and guided. Students are required to adjust to the instructor's personality and delivery style. An instructor usually paces the content to meet the learning abilities of the middle third in the class. Faster learners and the slower learners must adapt to the pace of the class in order to succeed. Surveys[1] show that 80% of Winter Park students prefer the most familiar lecture mode of instruction. Successful students in traditional courses usually like social interaction and respond to authority.

Academic Systems: Academic Systems[2] is an internet accessed software curriculum that provides students with the combination of lectures, practice problems and self administered assessment tests that measures and validates skill levels. The program is effective because it uses a combination of auditory, visual and kinesthetic techniques to encourage student learning.

It can be used either as a self-paced tool by the student or used as a semester course with instructor supervision. Winter Park integrates live lectures with the Academic Systems lectures, practice problems and assessments. The student progresses through the learning modules at a pace determined by the classroom instructor. Classes begin with the instructors offering a brief, 10-15 minute review of the daily concepts and then making themselves available to help students on a one-to-one basis for the remainder of the class.

One of the reasons this program is highly successful is because remedial math students also tend to be remedial readers. Academic Systems' lectures are read to the student while the student reads the lecture. The student is required to take notes during the computerized lecture.. As a student progresses through the content, interaction also occurs in which a student must correctly respond to computer-generated problems. Immediate feedback on the material reassures students of their knowledge or refers them back to the lecture content until mastery of the subject matter is demonstrated. As a web-based product, it is available any time of the day or night to students who have home computers and access to the internet. Successful Academic Systems students tend to be independent, structured learners and are linear processors of information.

ALEKS: ALEKS^3 is a non-traditional, non-linear internet based software program that adapts to each student's knowledge space. A knowledge space is a personalized mapping which inventories each student's math skills. Traditional lectures are not offered in this setting because students do not have similar knowledge spaces. ALEKS defines a student's knowledge space by administering frequent cumulative diagnostic tests. ALEKS gives the student freedom of choice in self-selecting a learning concept that builds on the defined knowledge space. By the end of the semester, a student must complete the knowledge space that corresponds to the elementary algebra competencies. No two students will pick the same learning path. Several students will often be learning within the same subgroup, so small group lectures, or sub-grouped students seated closely to each other, allows for personal interaction. Students are again responsible for selecting their own learning path and must obtain lecture notes from the software program.

The ALEKS system offers a streamlined version of mathematical concepts and demonstrates the concepts through mastery of practice problems. The program assumes mastery of a concept has been demonstrated when a student can correctly answer five similar questions. Mastery of the concept is not granted until the student successfully completes a cumulative assessment. A student's knowledge space can shrink if concepts are not retained. This system does not provide the auditory presentation that Academic System does, so the student must be able to read and comprehend the material presented. Many students who have not been successful in traditional learning environments embrace this system. Successful ALEKS students are usually independent, flexible learners who are non-traditional, open to new ideas, and decisive.

Brief Comparison of Learning Modalities

Lecture	Academic Systems	ALEKS
• 80% of students prefer this method • Instructor led learning. • Instructor can adjust course and content to meet the needs of most of the class.	• Students are responsible for their own learning • Visual, auditory and kinesthetic learning styles are engaged • Rigorous and structured linear learning • Immediate feedback • Available 24/7/365 • One-on-one help from an instructor or supplemental instructor	• Individual knowledge spaces are defined. • Students are responsible for their own, unique learning path. • Frequent cumulative diagnostic tests are administered. • Lecture and practice are available 24/7/365. • Immediate learning feedback is provided

The question of which delivery system is best depends on varying perspectives. Administrators, students and faculty have different expectations and determinants of satisfaction. The following chart summarizes what each group uses to measure the effectiveness of course delivery systems.

Course Satisfaction
Comparison of Administrative, Student and Faculty Perspectives

Administrators	Student	Faculty
Must be cost effective Must be able to assess results Are responsible to tax payers Want students to be successful	Want to be successful Want system to be cost effective Want 24/7/365 help - preferably live help Want learning styles addressed Want immediate feedback	Want students to be successful Want to interact with students Want a proven system Want students to become independent learners

Course management of the three delivery systems is also a concern for leaders.

Instructors as well as students must be correctly placed within each learning modality. Instructors have been taught how to be effective lecturers. Academic Systems and ALEKS train instructors how to navigate through the software programs, but there is no training available that shows how to manage the classroom environment. Learning how to manage a computerized augmented course is through trial and much error. A table is provided in Appendix A which summarizes suggestions that might help improve course and classroom management.

The cost of using different delivery systems must also be considered. The costs can be deceiving. To use a software program, it is assumed a college has a dedicated computer lab available for students during class time and outside of class time. Adequate technology support must be available for classroom and lab support. Security is also needed to monitor the technology room. Assuming all of the support systems are in place, then it is possible to compare the cost of implementing the programs.

Cost Comparison

	Lecture	Academic Systems	ALEKS
Start up cost		$360 license fee per computer - to be recouped through selling license with the text-book. Current cost of license and text $87	No cost for a pilot study. After the pilot the student assumes the license cost with the purchase of a text book. Current cost of book and license $117
Running Cost	Faculty	Faculty and Supplemental Instructor	Faculty and Supplemental Instructor

The question still remains, is there a delivery system that can satisfy all demands from all concerned parties? While the answer is obviously no, our research and findings do provide answers to which system produced the "best" retention rate and which system delivered the "best" student outcomes.

Goals of the Experiment

Since the strengths and weaknesses of each delivery system have been determined and the student and instructor characteristics that make each system effective have been identified, it

is time to move on to the actual assessment phase of the experiment. Remember, the overall purpose of the experiment is to determine if there is a significant difference in the effectiveness among the systems first using grades as an indicator, then retention rates, and finally student progress.

Experimental Design

Care was taken to ensure standardization and to maximize consistency throughout each course. Similar times were chosen for classes, and the same instructor was assigned to each course. The instructor did not have a pre-conceived opinion as to which system was "the best." Parallel tests were used for each class, including the State competency test and the final examination. The classes were large enough so that the majority of the students tended to have similar mathematical backgrounds and experience.

Students self-select and self-register for classes at Valencia, so the study could not randomly assign students to a learning modality. The class schedule specifically noted the modality used for each section and advisors were informed which learning style would benefit from each delivery system. However, students were allowed to register without the aid of advising. It should also be noted that ALEKS was the only elementary algebra class that was available for students enrolling near the end of registration. That meant that many of the ALEKS students did not really prefer that modality, but rather were automatically placed into the course.

Elementary algebra was selected to be the focus of this study because of the major impact it has on remedial students. ***The null hypothesis tests is student performance and retention will be the same for students enrolled in traditional lecture, Academic Systems or ALEKS based deliveries. The alternative hypothesis tests is there is a difference.*** All testing was performed at a 5% significance level.

Test Results

The traditional lecture class had the highest retention rate, ALEKS the lowest. Since late registering students were not given the choice of learning modes, the results are tainted. Valencia measures retention by calculating the ratio of completers to enrolled students after the drop/add period. Classes meet only once during the add/drop period. Any student who withdraws, for any reason, throughout the semester is counted against the retention rate. Since

Valencia uses this method to calculate retention, it is not possible to determine if students left a course because of financial hardships, life situations or because of difficulties with the course learning style. The comparison between modalities is still interesting to consider.

Student Summary

	Enrolled Students	Completers (A, B, C Grades)	Completer Percentage
Lecture	52	31	59.62%
Academic Systems	46	22	47.83%
ALEKS	49	19	38.78%

A completer for a prep course must have a grade of A, B, or C. A student who receives a W or WP (withdraw passing) receives no grade, no credit for the class, but this grade does count as an attempt. A grade of WF (withdraw failing) counts as an F. A WP or WF is given after the official withdrawal deadline has passed, roughly two-thirds of the way through the semester. Both ALEKS and Academic Systems experienced a high withdrawal rate that greatly reduced the number of completers. ALEKS also had a high number of students who did not withdraw from the class, and failed to pass the State Competency Test. Those students received a WP for their grade.

Chi-Square analysis gave a p-value of .048 and testing at $\alpha = 5\%$ there was sufficient evidence to conclude that there is a difference in the retention rates in the system. Further analysis determined that there is a significant difference between Lecture and ALEKS.

Testing Differences in Retention Rates

2 proportion comparison test	Lecture vs. Academic Systems	Lecture vs. ALEKS	Academic Systems vs. ALEKS
P-Value	.6463	.0384	.1192

The experiment was designed to determine if student learning would be affected by the delivery modality. The best indicator of student outcomes was believed to be the grade distribution for each course. After examining the initial results, it became apparent that the high withdrawal rates were confounding the learning results. Because so many students initially were misplaced into ALEKS and several into Academic Systems, it was apparent that a different indicator had to be used to compare the learning results.

The researchers concluded that removing the withdrawals from the study would give a

more accurate, non-biased method of comparing and contrasting student learning. Testing the difference in the completion rates, the percentage of students earning a grade of A, B, or C, in each system once the withdrawals were removed yielded a p-value of 0.376.

Testing the Differences of Completion Rates
(Withdrawals Removed)

Grades vs. Delivery System	Sum of Squares	DF	Mean Square	F	Sig
Between groups	3.924	2	1.962	.989	.376
Within Groups	160.648	81	1.983		
Total	164.571	83			

Using α = 5%, there is insufficient data to conclude there is a difference in completion rates among the learning modalities. This verifies the necessity of properly placing students (and faculty) in the correct learning style modality. Advisors, students and faculty must become more actively involved in addressing this concern.

The study traced the progression of students enrolling in subsequent courses for a one year period. The sequential course, intermediate algebra, was only offered in the traditional lecture format. A concern was that students who had completed elementary algebra using Academic Systems or ALEKS would have a hard transition returning to a traditional classroom. Although the sample size was too small to make valid statistical results, however, the results showed that there was no significant difference in the success rate for intermediate algebra. Tracing the remaining students into the college level sequence, college algebra, college math or liberal arts math, showed again no significant difference in the completion rate. This information does reinforce Valencia's Start Right policy, start right, finish strong.

Advisors, faculty and administrators have always suspected that a student's reading ability affects the success level in all courses. Since this study collected the CPT scores on reading, writing, algebra and arithmetic, it seemed reasonable to see if any of these factors influenced the students completion rate for elementary algebra. The Pearson Correlation test was used to see if CPT scores did affect grade outcomes. The following table presents the test results.

Correlations between CPT Scores and Grades

		Grades	CPTA	CPTR	CPTW
Pearson Correlation	Grades	1.000	.096	.185	.070
	CPTA	0.96	1.000	.103	.137
	CPTR	.185	.103	1.000	.620
	CPTW	.070	.137	.620	1.000
Sig. 1-Tailed	Grades	.173	.244	.034	.180
	CPTA	.173		.155	.088
	CPTR	.034	.155		.000
	CPTW	.244	.088	.000	

Using a significance level of 5%, there is sufficient data to support that a student's incoming reading ability does affect the grade outcome for elementary algebra students. There is also an extremely strong correlation between a student's reading and writing scores. The next logical step in study would be to compare the grade outcomes in each modality for students with the same reading ability. Because of the extremely small sample size that would result from this grouping, it was impossible to conduct this research. It is highly suspected that students with lower reading abilities would be more successful using Academic Systems because the content is presented in written form on the computer monitor while it is also being read to the student. It is the hope that other researchers will investigate this further.

Surveys were sent out to every student involved in this study to see what recommendations, changes or suggestions would help future students succeed in these courses and help learning leaders plan for the future. Each question with a brief summary of student comments is included in the Appendix B.

Summary of the Research Findings

There was not a significant difference in student outcomes when students were placed in a learning modality that reflected their preferred learning style. Lecture was the preferred method of instruction for approximately 83% of remedial elementary algebra students. Since the vast majority of remedial students prefer the lecture modality and since this type of instruction is the most cost effective, does this mean that lecture should be the only method of instruction and learning? No, because 17% of the enrolled students in this study were non-traditional learners and they wanted and needed access to alternative learning methods.

The researchers hope that any institution that is considering offering any of the alternative learning methods actively inform and involve faculty, advisors and students in the decision. Faculty and students should not be placed into an alternative system without taking into account their learning styles and personality traits. In addition, it is essential that course listings should include a detailed description of the learning modality. Faculty should be well trained, either by the software distributor or by a peer, to navigate through the software program, to be able to correct minor technical problems, and to be mentored by a more experienced user throughout the initial semester. Ideally, a first time instructor would have shadowed and helped in a previous class. Advisors should also participate in a class and understand the strengths and weaknesses of each system. Advisors should then be able to recommend a compatible system based on the student's strengths, weaknesses and learning style. Finally, successful students need to be active proponents for each system. Students believe fellow students over faculty and advisors.

If Valencia had more resources and the Winter Park Campus had a larger student body, all three methods would still be offered. However, Valencia is operating under an administrative philosophy of doing more with less. The Winter Park Campus has serious capacity constraints and because there are only 225 students enrolled in elementary algebra, only lecture classes are currently offered. The non-traditional learners could easily fill an Academic Systems or ALEKS class, but not both. It is also impossible for all non-traditional students to enroll in one class section because of conflicting work and class schedules.

The search for increased effectiveness, higher levels of student learning outcomes and customer satisfaction is continuing at Valencia Community College. Our latest evolutionary initiative involves the introduction of "*enhanced lecture*" classes. *Enhanced lecture* includes offering more interactive learning in the classroom. There are more paired classroom assignments that re-enforce the classroom instruction. Students are given prepared lecture notes and must fill in the missing statements and work out example problems with the instructor during the lectures. Any student who misses a class, or earns below a 70% on any assignment, is mandated to attend the math student support center before returning to class. Students are also required to keep a course notebook and must keep in chronological order the following sections:

lecture notes, homework, classroom assignments, tests, and a student support center log. Students grade their own work using the same rubric that the instructor uses to grade on test days. In keeping with Valencia's Start Right Initiative, the enhanced lecture course will be assessed at the end of the term, and again in one year by tracing student progress in subsequent courses.

It is the goal of faculty, administrators and advisors that all under-prepared students achieve success in the prep program and become successful college level students. There are actions that every participant in the educational system can take to increasing learning outcomes. Administrators need to become more aware of student learning styles and respect these differences by offering a variety of learning opportunities. Advisors need to direct students with limited reading abilities into learning modalities that read content to the students. Educators need to build strong foundations, teach student study skills, have high expectations, and provide more interactive learning opportunities. And students must be held accountable and required to take responsibility for their learning and determining the most appropriate method of instruction.

Future researches need to determine if students with lower reading abilities are more successful using Academic Systems, and if those students with high end algebra scores need the briefer review that ALEKS offers. Future research also should study how, and if, student support centers impact learning. Remedial education is a growing concern and as learning leaders we must challenge ourselves and each other to find both the most learning effective modality, and the most cost efficient methods of instruction. After all, colleges must be conservators of resources. Therefore, instructional courses must be offered that have the produce the most immediate and direct student outcomes while still being cost effective.

If you would like additional information please contact the authors

mmcclendon@valencia.cc.fl.us

mmcardle@valencia.cc.fl.us

Footnotes

1 Student Survey, Valencia Community College, Winter Park Campus. March, 2001. Mailed to all enrolled students participating in the study.

2 For readers wanting to know more about Academic Systems, please visit their website at www.academic.com

3 For readers wanting to know more about ALEKS, please visit their website at www.highed.aleks.com

APPENDIX A

Course Management Suggestions

LECTURE

Instructor should

- Prepare a 5 minute quiz over assigned homework
- Provide lab activities that re-enforce classroom learning
- Lecture for only 10-15 minutes then offer interactive learning
- Pace the class to meet the needs of the middle third
- Be able to provide alternative methods of explanation
- Provide an open learning environment where students are comfortable asking question
- Be encouraging

The student should

- Attend class faithfully
- Take notes
- Ask questions
- Come to class prepared
- Keep a portfolio

The course should

- Be relevant
- Be interesting
- Have a paper and pencil test over each chapter
- A text that offers alternative help; software support, smart CD Rom that provides lectures and sample tests
- Be supported by a math student support lab, fully equipped with tutors, software, and video tapes

ACADEMIC SYSTEMS

Instructor should

- Be able to respond quickly to unrelated questions
- Energetic and willing to approach students
- Track student progress weekly, if not daily
- Lecture for 10-15 minutes each class
- Prepare a 5 minute quiz over assigned homework
- Check for homework completeness daily
- Do not wait for student questions, be invasive
- Make sure students are on task and off their email
- Thoroughly understand how to navigate through the system

The students should

- Be willing to ask for help
- Maintain a portfolio showing progress
- Be willing to repeat information until mastery is demonstrated

Each classroom session should

- Include a mini homework quiz
- Include a brief lecture
- Reserve time for student interaction
- Check homework for completeness
- Monitors turned off during lecture time

The course should have

- Paper and pencil tests over each learning module
- Assigned homework problems not computer assigned problems
- A systems administrator on call during class
- Be supported with a math student support center

ALEKS

Instructor should

- Flexible, yet provide leadership
- Be able to respond quickly to unrelated questions
- Be energetic and willing to approach students
- Track student progress weekly, if not daily
- Be able to offer mini lectures on a variety of topics to different grouped students
- Have an individualized daily lesson plan for every student
- Group students by ALEKS "Ready to Learn" lesson plans
- Prepare multiple 5 minute quizzes for each group of students by "Ready to Learn" homework problems

The students should

- Be independent learners
- Be able to make decisions concerning their learning path
- Keep a portfolio of weekly ALEKS progress, time on task log, and home work problems completed
- Be willing to ask for help

Each classroom session should include

- 5 minute quiz over homework
- Have small group lectures
- Reserve time for student interaction
- Assigned homework problems checked for completeness

The course should have

- At least 4 instructor requested computer diagnostic tests during the semester
- Paper and pencil tests when a student completed 85-90% of a slice
- A textbook keyed to ALEKS with a smart CD Rom that provides lectures
- Have a supplemental instructor whose sole purpose is to help individual students
- Have a systems administrator on call during class
- Be supported with a math student support center

APPENDIX B

Student Survey Results

Question	Lecture	Academic Systems	ALEKS
List 3 features that helped you to learn in the course	Support Center Video Tapes Study Partners Asking questions in class Examples The book Practice tests available online through MATHXL Doing homework Immediate answers to questions	The computer The instructor The program I could move ahead on the computer	The on-site instructor ALEKS Homework Using the CD that came with the book for lectures at home It was almost self-paced Examples at the beginning of each slice Individualized - no pressure The repetition made sure you really understood what was being taught
List 3 features that were obstacles to your learning	Other students Support center Instructor paid too much attention to students who didn't want to try Computer work and tests Only the answers were in the book, not the solutions Too fast of pace Too much information in one course	Too much homework Not enough review time prior to a test Word problems Had trouble setting up the system at home System was down periodically Lack of communication with instructor	ALEKS Computer was confusing Math wasn't taught like this in high school. Its too different. Program didn't work all the time My home computer shuts down too much using this program. Trying to get on-line It didn't explain each step to me Assessments took too much time
What one thing would you change to make the course more effective for you?	Spend more time in the support center Get more help from the teacher, support center and my friends Get rid of whining students during class Take class later in the day More time should be spent in class Do more homework and do the computer work	Have a whole day of review before a test Make the system easier to set up at home	Make us do the chapter tests on the book CD All I can say is at the beginning of the semester I really hated ALEKS, but once I got used to it and buckled down, I really enjoyed learning from the program The amount of points the assessment takes away from you if you make a mistake

If you were to take this course again, which method of instruction would you select?	All but one selected lecture One student replied any method would be fine	All but one selected Academic Systems One chose Lecture	Respondents equally chose lecture, Academic systems and ALEKS
Additional comments	If I can learn algebra at the age of 31, anyone can Make only students with low grades use the support center My work schedule didn't allow me to go to the support center	Academic systems is much better than ALEKS because it goes in order and you get tested along the way I liked the disc and extra work at home. It won't let you move on until you really understand. The teacher answers everybody's questions You can learn at your own pace, not the class pace I had to drop because the program was confusing and hard to follow. The teacher didn't know what she was doing and you ought to get rid of this program.	Spend more time on each slice ALEKS offered me much more than a book could have. You can listen to music while you do ALEKS and that helps you relax and do the math